

WHAT IS CLAIMED IS:

1. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander, an indoor heat exchanger and an auxiliary compressor, in which said auxiliary compressor is driven by power recover by said expander, wherein when refrigerant flows using said indoor heat exchanger as an evaporator, a discharge side of said auxiliary compressor becomes a suction side of said compressor, and when refrigerant flows using said indoor heat exchanger as a gas cooler, a discharge side of said compressor becomes a suction side of said auxiliary compressor.

2. A refrigeration cycle apparatus according to claim 1, further comprising a first four-way valve to which a discharge side pipe and a suction side pipe of said compressor are connected, a second four-way valve to which a discharge side pipe and a suction side pipe of said expander are connected, and a third four-way valve to which a discharge side pipe and a suction side pipe of said auxiliary compressor are connected, wherein when refrigerant flows using said indoor heat exchanger as the evaporator, the discharge side of said auxiliary compressor becomes the suction side of said compressor, and when refrigerant flows using said indoor heat exchanger as the gas cooler, the discharge side of said compressor becomes the suction side of said auxiliary compressor by said first four-way valve and said third four-way valve, and a direction of

refrigerant flowing through said expander is always set in the same direction by said second four-way valve.

3. A refrigeration cycle apparatus according to claim 2, wherein at least one of said second four-way valve and said third four-way valve is replaced by a check valve bridge circuit comprising four check valves.

4. A refrigeration cycle apparatus according to claim 1, further comprising a bypass circuit which reduces an amount of refrigerant flowing into said expander, and a bypass valve which adjusts an amount of refrigerant flowing through said bypass circuit.

5. A refrigeration cycle apparatus according to claim 1, further comprising a pre-expansion valve which increases an amount of refrigerant flowing into said expander.

6. A refrigeration cycle apparatus according to claim 1, wherein a suction capacity of said compressor is set to 3 to 6 times of a suction capacity of said expander.

7. A refrigeration cycle apparatus according to claim 1, wherein a suction capacity of said compressor is set to 4 times of a suction capacity of said expander, and a suction capacity

of said auxiliary compressor is set to 4.3 times of the suction capacity of said expander.

8. A refrigeration cycle apparatus according to claim 1, wherein a cooling operation rated frequency of said compressor and a cooling operation rated frequency of said auxiliary compressor are the same frequency.

9. A refrigeration cycle apparatus according to claim 1, wherein an operation frequency of said auxiliary compressor is set lower than an operation frequency of said compressor.

10. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein a sub-expander is provided in parallel to said expander, and an electric generator is connected to said sub-expander.

11. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its suction side with a sub-expander, and an electric generator is connected to said sub-expander.

12. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its discharge side with a sub-expander, and an electric generator is connected to said sub-expander.

13. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its suction side with a first sub-expander, a second sub-expander is provided in parallel to said expander and said first sub-expander, and electric generators are connected to said first sub-expander and said second sub-expander, respectively.

14. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its suction side with a sub-expander, a bypass flow path is provided in parallel to said

expander and said sub-expander; and said bypass flow path is provided with a bypass valve.

15. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its suction side with a pre-expansion valve, a sub-expander is provided in parallel to said expander and said pre-expansion valve, and an electric generator is connected to said sub-expander.

16. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its suction side with a first sub-expander, a second sub-expander is provided in parallel to said expander and said first sub-expander, an electric generator connected to said first sub-expander is an electric generator connected to said second sub-expander, and said electric generator includes a clutch mechanism which is connected to one of said first sub-expander and said second sub-expander.

17. A refrigeration cycle apparatus using carbon dioxide as refrigerant and having a compressor, an outdoor heat exchanger, an expander and an indoor heat exchanger, in which said power recover by said expander is used for driving said compressor, wherein said expander is provided at its discharge side with a first sub-expander, a second expander is provided in parallel to said expander and said first sub-expander, an electric generator connected to said first sub-expander is an electric generator connected to said second sub-expander, and said electric generator includes a clutch mechanism which is connected to one of said first sub-expander and said second sub-expander.

18. A refrigeration cycle apparatus according to any one of claims 10 to 17, wherein the suction side of said compressor or the discharge side of said compressor is provided with said auxiliary compressor, and power recover by said expander is used as power for driving said auxiliary compressor instead of said compressor.

19. A refrigeration cycle apparatus according to any one of claims 10 to 17, further comprising a first four-way valve to which a discharge side pipe and a suction side pipe of said compressor are connected, and a second four-way valve to which discharge side pipes and suction side pipes of said expander and said sub-expander are connected, wherein refrigerant

discharged from said compressor is selectively allowed to flow into said indoor heat exchanger or said outdoor heat exchanger by said first four-way valve, a direction of refrigerant flowing through said expander and said sub-expander is always set in the same direction by said second four-way valve.

20. A refrigeration cycle apparatus according to claim 18, further comprising a first four-way valve to which discharge side pipes and suction side pipes of said compressor and said auxiliary compressor are connected, and a second four-way valve to which discharge side pipes and suction side pipes of said expander and said sub-expander are connected, wherein refrigerant discharged from said compressor and said auxiliary compressor is selectively allowed to flow into said indoor heat exchanger or said outdoor heat exchanger by said first four-way valve, a direction of refrigerant flowing through said expander and said sub-expander is always set in the same direction by said second four-way valve.